

Application/Control Number: 10/796,744

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WHAT IS CLAIMED IS:

1. A copackaged device containing a plurality of electronic devices defining at least a portion of a circuit, said device comprising:

a lead frame having a pad and a plurality of leads extending away from the pad, at least one of the plurality of leads being electrically connected to the pad, the pad having a mounting surface and a bottom surface opposite of the mounting surface, the mounting surface being electrically conductive;

a power switching device comprising a semiconductor die, a first electrode on a first surface of the die, and a second electrode and a third electrode on an opposite surface of the die, the first electrode being mounted and electrically connected to the mounting surface of the pad of the lead frame;

an integrated circuit having logic circuitry for controlling the power switching device, the integrated circuit being mounted on the opposite surface of the die of the power switching device and being operably electrically coupled to the power switching device such that the integrated circuit is capable of controlling the switching of the integrated circuit in response to signals received from the circuit;

a diode die having a cathode electrode on a first surface and an anode electrode on a second surface opposite of the first surface, wherein the cathode is wire bondable and the anode electrode is mounted and electrically connected to the mounting surface of the pad of the lead frame such that the diode die is laterally removed from the power switching device and is electrically coupled to the first electrode of the power switching device.

2. The device of claim 1, wherein the bottom surface of the pad of the lead frame is exposed, such that the bottom surface is configured to mount a heat sink operable for direct thermal heat transfer from the pad of the lead frame.

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3. The device of claim 1, wherein the cathode electrode of the diode die is of an aluminum.

4. The device of claim 3, wherein the diode die includes a termination structure at least partially surrounding the anode electrode and the diode die has a passivation layer at least partially surrounding the anode, such that the passivation layer shields the termination structure of the diode die.

5. The device of claim 1, wherein the circuit is a power factor correction circuit.

6. The device of claim 2, wherein the circuit is a power factor correction circuit.

7. The device of claim 3, wherein the circuit is a power factor correction circuit.

8. The device of claim 4, wherein the circuit is a power factor correction circuit.

9. The device of claim 5, wherein the plurality of leads consists of five leads and the five leads extend from one edge of the pad and a first lead and a second lead of the five leads are wire bonded to contacts disposed on the opposite surface of the integrated circuit, a third lead of the five leads is integrally attached to the pad, the fourth lead is wire bonded to one of the second electrode and the third electrode of the power switching device and the fifth lead of the five leads is wire bonded to the cathode electrode of the diode die.

14. A copackaged device for connection to an external circuit, comprising:
a lead frame having a pad and a plurality of leads extending in a direction away from the pad, at least one of the plurality of leads being electrically connected

to the pad, the pad having a mounting surface and a bottom surface opposite of the mounting surface, the mounting surface being electrically conductive;

a power switching device comprising a semiconductor die, a first electrode on a first surface of the die, and a second electrode and a third electrode on an opposite surface of the die, the first electrode being mounted and electrically connected to the mounting surface of the pad of the lead frame;

an integrated circuit having logic circuitry for controlling the power switching device, the integrated circuit being mounted on the opposite surface of the die of the power switching device and being operably electrically coupled to the power switching device such that the integrated circuit is capable of controlling the switching of the integrated circuit in response to signals received from the external circuit; and

a diode package comprising a first diode die having a first anode and a first cathode, a second diode die having a second anode and a second cathode, and a diode contact pad mounted on the lead frame by an insulating layer, wherein the second anode is mounted on and electrically coupled to the diode contact pad and the first cathode is mounted on and electrically coupled to the diode contact pad such that the first diode and the second diode are mounted side by side and electrically connected in series by the diode contact pad, the first anode being electrically coupled to the first electrode of the power switching device and the second cathode being electrically coupled to one of the plurality of leads such that the integrated circuit, the power transformer and the diode package define a portion of an electrical circuit.

15. The device of claim 14, wherein the second anode is of a solderable aluminum and the second cathode is of a wire-bondable copper, wherein the second anode is coupled to the diode contact pad by a solder layer and second cathode is coupled to the one of the plurality of leads by at least one wire bond.

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16. The device of claim 15, wherein the insulating layer is sandwiched between the lead frame and the diode contact pad such that no electrical contact is made between the diode contact pad and the lead frame.

17. The device of claim 16, wherein the insulating layer is mounted on the mounting surface of the lead frame.

18. The device of claim 16, wherein the insulating layer is mounted on the bottom surface of the lead frame.

19. The device of claim 15, wherein the mounting surface is electrically coupled by a wire bond to a pin contact pad of one of the plurality of leads and the first anode of the first diode is electrically coupled by another wire bond to a pin contact pad of one of the plurality of leads such that the power switching device is operably coupled to the first anode during operation of the device.

20. The device of claim 19, wherein the pin contact pad coupled to the first anode of the first diode is a different pin contact pad than the pin contact pad coupled to the mounting surface, such that the power switching device is operably coupled to the first anode of the first diode by the external circuit during operation of the device.

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